



Short communication

Flowering calendar of grasses in Srinagar, Kashmir Himalaya (India)

A.H. Munshi

Department of Botany, University of Kashmir, Srinagar, India

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Abstract

Several grass pollens are important environmental bio-pollutants, causing various allergic disorders in susceptible persons. Therefore, it is essential to study the period and duration of the flowering of the plants growing in a particular region/area. For the area Srinagar (Kashmir Himalaya), a flowering calendar of grasses consisting of 57 species which fall under 35 genera has been compiled in order to provide an understanding of habit, period of pollen release and their dispersal from the flowers, pollen load in the atmosphere and the influence of meteorological parameters.

The main object of this research work is to provide an information regarding the frequency of grass pollen in atmosphere to the physicians, or medical practitioners. The maximum flowering period is recorded from July to September.

Introduction

It is becoming increasingly evident that pollen is only one of many environmental factors, collectively designated as “pollutants”, which are suspected to contribute to the world wide increase in hypersensitivity experienced by the human population, especially in developed countries. Hence to study pollen, it is mandatory to know the exact period of flowering among plants along with their correct nomenclature. In India, especially in tropical climates, some research work has been carried out on compiling the flowering calendar and pollination calendar (Appana, 1980; Das et al., 1987; Mari Bhat et al., 1982; Panda et al., 1992) However, the Kashmir Himalaya, which is a major part of the western Himalaya and enjoys mostly temperate-alpine climate, has not been investigated for such type of research work. Even though it is rich in angiospermic plants, especially grasses.

A large number of grasses have already been reported to produce allergenic pollen in Europe and other parts of the globe. So an effort has been made to conduct extensive survey of the grasses growing in

Srinagar and its environment of Kashmir Himalaya. Previously such type of research information was not available from this region and therefore detailed flowering calendar of grasses has been compiled for the first time (Table 1).

Materials and methods

Regular and repeated visits to different areas of the Srinagar district were made during the flowering season of grasses and a detailed flowering calendar was compiled for 1996–1997. A variation in flowering periods in some species growing at different altitudes and areas was recorded. The herbarium specimen was identified by matching with a voucher specimen deposited in the herbarium, of the Department of Botany, University of Kashmir, Srinagar, India (KASH).

Flowering periods were correlated with other parameters like behaviour altitude, pollen emission, pollen load in the atmosphere. The genera and species of grasses were arranged alphabetically (Table 1). The pollen load in the atmosphere at various altitudes was

Table 1. Flowering calendar of grasses showing variation in behaviour, altitude flowering period, pollen incidence and pollen load (peak). Growing in district Srinagar of Kashmir Himalaya (India). *Behaviour* Ann = Annual and Per = Perennial.

Name of the grass species	Behaviour	Altitude range (meters)	Flowering periods	Pollen incidence	Pollen loads (peaks)
<i>Aegilops</i>					
<i>A. tauschii</i>	Ann.	1,700–2,000	April–July	May–June	June
<i>Agropyron</i>					
<i>A. Semicostatum</i>	Per.	1,700–2000	May–July	June–July	June–July
<i>Agrostis</i>					
<i>A. canina</i>	Per.	1,700–3,100	June–August	July–August	July
<i>A. pilosula</i>	Per.	1,700–2,500	July–October	July–August	July–August
<i>A. stolonifera</i>	Per.	1,700–2,700	June–October	July–September	July–August
<i>A. subaristata</i>	Per.	1,700–2,300	July–August	July–August	July
<i>Alopecurus</i>					
<i>A. acqualis</i>	Ann.	1,700	April–May	May	May
<i>A. arundinaceous</i>	Per.	1,700–2,100	April–June	May–June	May
<i>A. himalaicus</i>	Per.	3,200–3,800	July–September	July–August	August
<i>Arthraxon</i>					
<i>A. lancifolius</i>	Per.	1,700–1,900	July–September	July–August	August
<i>A. prionodes</i>	Per.	1,700–1,900	April–June	May–June	May
<i>Avena</i>					
<i>A. fatua</i>	Ann.	1,700–1,900	April–June	May–June	May
<i>Bothriochloa</i>					
<i>B. pertusa</i>	Per.	1,700–2,300	July–October	July–August	August
<i>B. glabra</i>	Per.	1,800–2,000	July–September	July–August	August
<i>Brachiaria</i>					
<i>B. eruciformis</i>	Ann.	1,700–1,800	July–September	July–August	August
<i>Bromus</i>					
<i>B. japonicus</i>	Ann.	1,700–2,100	May–June	May–June	May–June
<i>B. mollis</i>	Ann.	1,700–1,800	May–September	June–August	July–August
<i>Capillipedium</i>					
<i>C. Parviflorum</i>	Per.	1,700	July–September	July–August	August
<i>Chrysopogon</i>					
<i>C. echinulatus</i>	Per.	1,700–2,300	July–October	July–August	July–August
<i>Cynodon</i>					
<i>C. dactylon</i>	Per.	1,700–2,400	May–November	June–September	July–September
<i>Dactylis</i>					
<i>D. glomerata</i>	Per.	1,700–2,700	April–July	May–June	May–June
<i>Digitaria</i>					
<i>D. adscendens</i>	Ann.	1,700	July–August	July–August	July
<i>D. granularis</i>	Ann.	1,700–1,800	July–September	July–August	July–August
<i>D. sanguinale</i>	Ann.	1,700–1,900	June–September	July–August	July
<i>Echinochloa</i>					
<i>E. colonum</i>	Ann.	1,700–1,900	June–September	July–August	August
<i>E. crusgalli</i>	Ann.	1,700–1,900	July–September	July–August	August
<i>Hordeum</i>					
<i>H. leporinum</i>	Ann.	1,700–1,800	April–June	May–June	May–June
<i>Koeleria</i>					
<i>K. cristata</i>	Per.	1,700–2,200	April–May	May	May
<i>Lolium</i>					
<i>L. temelentum</i>	Ann.	1,700–1,800	May–June	May–June	May
<i>Lophochloa</i>					
<i>L. phleoides</i>	Ann.	1,700–1,800	April–May	May	May
<i>Muhlenbergia</i>					
<i>M. huegelii</i>	Per.	2,500	July–September	June–August	July–August
<i>Oryzopsis</i>					
<i>O. munroi</i>	Per.	1,700–2,300	May–September	June–August	July–August
<i>Pennisetum</i>					
<i>P. flaccidum</i>	Per.	1,700–2,500	May–November	June–September	August–September
<i>P. orientale</i>	Per.	1,700–2,500	May–November	June–September	August–September

Table 1. Continued.

Name of the grass species	Behaviour	Altitude range (meters)	Flowering periods	Pollen incidence	Pollen loads (peaks)
Phacelurus					
<i>P. speciosus</i>	Per.	1,700–2,300	July–September	June–August	July–August
Phalaris					
<i>P. arundinacea</i>	Per.	1,700	May–June	May–June	May–June
Phleum					
<i>P. alpinum</i>	Per.	2,700–3,700	August–September	August	August
<i>P. graecum</i>	Ann.	1,800–2,500	May–June	May–June	June
<i>P. paniculatum</i>	Ann.	1,700–2,000	May–June	May–June	May–June
Phragmites					
<i>P. communis</i>	Per.	1,700–2,200	July–October	July–September	August–September
Poa					
<i>P. annua</i>	Ann.	1,700–2,300	March–November	May–September	June–September
<i>P. angustifolia</i>	Per.	1,700–2,100	April–June	May–June	May–June
<i>P. bulbosa</i>	Per.	1,700–2,600	April–May	April–May	May
<i>P. pratensis</i>	Per.	1,700–2,100	May–September	May–August	May–July
<i>P. sterilis</i>	Per.	1,800–2,900	April–May	April–May	April–May
<i>P. stewartiana</i>	Per.	1,700–2,600	April–May	April–May	April–May
Polypogon					
<i>P. fugax</i>	Ann.	1,700–2,300	June–September	June–September	August–September
Sclerochloa					
<i>S. dura</i>	Ann.	1,700	May–July	June–July	June–July
Setaria					
<i>S. glauca</i>	Ann.	1,700–1,900	August–October	August–October	August–September
<i>S. viridis</i>	Ann.	1,700–2,100	July–September	August–September	August
Sorghum					
<i>S. halepense</i>	Per.	1,700–1,900	July–October	July–September	August–September
Stipa					
<i>S. sibirica</i>	Per.	1,700–2,800	August–October	September–October	September
Themeda					
<i>T. anathera</i>	Per.	1,700–2,500	July–October	August–October	August–September
Tripogon					
<i>T. purpurascens</i>	Per.	1,700–2,100	July–September	August–September	August
Vulpia					
<i>V. myuros</i>	Ann.	1,700–2,500	April–June	April–June	May

recorded with vertical cylinder rods (Reddy, 1970; Agasha, 1980) and modified by Munshi (1992, 1994).

Results

57 species of grasses growing at various altitudes in the area of Srinagar, Kashmir Himalaya were recorded and identified. All these species were studied for behaviour, altitude, flowering period, pollen emission, pollen peaks and pollen load. The list of species includes the species of grasses already known as source of hayfever in Germany, France, Canada, USA, Africa, Central or South America and the Mediterranean (Table 2). The prevalence of these grasses

has now been recorded for the first time in Kashmir Himalaya.

Flowering calendar

A flowering calendar for all the species of grasses growing at various altitudes in the area was worked at. The flowering periods reveal that grasses in this region flower just after the rainy season is over. The flowering starts earlier at lower altitudes and late at higher altitudes. Some grasses flower for a short period (April–May or April–June) as can be seen in Table 1. Normally the flowering of all the grasses ends in September–October of the same year. The peak flowering periods generally last for one–two months.

Table 2. Distribution of the principal grasses producing allergenic pollen in the world and in the district of Srinagar in Kashmir Himalaya (India).

Botanical name of the grass	U.S.A.	Central or South America	Canada	Africa	U.K.	Germany	France	Mediterranean	Srinagar district
Agrostis									
<i>A. stolonifera</i>	+	+	+	–	+	+	+	+	+
Avena									
<i>A. fatua</i>	+	+	–	–	+	+	+	+	+
Cynodon									
<i>C. dactylon</i>	+	+	–	+	+	+	+	+	+
Dactylis									
<i>D. glomerata</i>	+	+	–	–	+	+	+	+	+
Eragrostis									
<i>E. pilosa</i>	–	–	–	–	+	+	+	+	+
Lolium									
<i>L. temulentum</i>	+	+	+	–	+	+	+	+	+
Phleum									
<i>P. alpinum</i>	+	+	+	–	+	+	+	+	+
Poa									
<i>P. pratensis</i>	+	+	+	–	+	+	+	+	+

Discussion

A comprehensive flowering calendar of grasses growing in the area is important and useful for diagnosis and treatment of allergic disorders and for research studies related to plant breeding systems. In the present studies, an effort has been made for the first time to record pollen peaks in the areas of the study. Such type of study needs further investigation to assess the total pollen grain load in the atmosphere of this region and correlate the data with clinical trials and tests. The present investigation is interesting (Table 2) as it records the pollen of grass species already known as allergenic in other parts of the world with cold temperate climate like UK, Germany, France, Canada, USA, Africa, Central or Southern America, Mediterranean region (Hyde et al., 1945; Stanley et al., 1983). Besides, it has been observed that early spring rain has decisive influence on flowering initiation and duration of the peak flowering periods.

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